MISSOURI FOREST PEST REPORT 1986

Missouri Department of CONSERVATION

Forestry Division

MISSOURI FOREST PEST REPORT

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INSECTS OBSERVED IN 1986 - DISCUSSED IN REPORT

1. Black Turpentine Beetle, Dendroctonus terebrans, (Oliv.)
2. Bronze Birch Borer, Agrilus anxius, (Gory)
3. Carpenterworm, Prionoxystus robiniae, (Peck)
4. Cottonwood Borer, Plectrodera scalator, (F.)
5. Cottonwood Leaf Beetle, Chrysomela scripta, (F.)
6. Cottonwood Twig Borer, Gypsonomia haimbachiana, (Kft.)
7. Eastern Tent Caterpillar, Malacosoma americanum, (F.)
8. European Pine Sawfly, Neodiprion sertifer, (Geoff.)
9. Evergreen Bagworm, Thyriodopteryx ephemeraeformis, (Haw.)
10. Fall Webworm, Hyphantria cunea, (Drury)
11. Gall Insects
12. Gypsy Moth, Porthetria dispar, (L.)
13. Ips Beetle, Ips sp.
14. Kermes Scale, Kermes pubescens (Bogue)
15. Loblolly Pine Sawfly, Neodiprion taedae linearis, (Ross.)
16. Looper Complex
17. Pales Weevil, Hylobius pales, (Hbst.)
18. Pine Needle Scale, Phenacaspis pinifoliae, (Fitch)
19. Pine Tortise Scale, Toumeyella numismatica, (P. & McD.)
20. Poplar Tent Maker, Ichthyura inclusa, (Hbn.)
21. Red Oak Borer, Enapholodes rufulus, (Haldeman)
22. Redheaded Pine Sawfly, Neodiprion leconte, (Fitch)
23. Spider Mites, Oligonychus spp. and Tetranychus spp.
24. True Tree Grasshopper, Dendrotettix quercus, (Pack.)
25. Two-Lined Chestnut Borer, Agrilus bilineatus, (Web.)

26. Walnut Caterpillar, Datana integerrima, (G. & P.)

27. White Pine Aphid, Cinara strobi (Fitch)

INSECTS OBSERVED IN 1986 - NOT DISCUSSED IN REPORT

1. Asiatic Oak Weevil, Cyrtepistomus castaneus, (Roelofs)
2. Bald-faced Hornet, Vespula maculata, (Linn.)
3. Boxelder Bug, Leptocoris trivittatus, (Say)
4. Carpenter Bee, Xylocopa virginica, (Linn.)
5. Cicada Killer Wasp, Sphecius speciosus, (Drury)
6. Elm Leaf Beetle, Pyrrhalta luteola, (Mueller)
7. Eyed Click Beetle, Alaus oculatus, (Linn.)
8. June Beetle, Phyllophaga sp.
9. Lace Bug, Corythucha ciliata, (Say)
10. Mourning Cloak Butterfly, Nymphalis antiopa, (Linn.)
11. Obscure Scale, Melanaspis obscura, (Comstock)
12. Potter's Wasp, Eumenes fraternus, (Say.)
13. Twig Girdler, Oncideres cingulata, (Say)
14. Twig Pruner, Elaphidionoides villosus (Fabricius)
15. Walking Stick, Diapheromera femorata, (Say)
16. Wheel Bug, Arilus cristatus, (Linn.)

DISEASES OBSERVED IN 1986 - DISCUSSED IN FOREST AND ORNAMENTAL TREE DISEASE SECTION

1. Diplodia Blight, *Sphaeropsis sapinea* (Fr.) Dyko & Sutton
2. Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau
3. Oak Decline, weather and various secondary agents
4. Oak Wilt, *Ceratocystis fagacearum* (Bretz) Hunt
5. Pine Wilt Disease, *Bursaphelenchus xylophilus* (Steiner and Buhrer) Nickle

OTHER DISEASES OBSERVED IN 1986

1. Anthracnose (Ash), *Gloeosporium aridum* Ell. & Holw.
   (Hickory), *Gnomonia caryae* Wolf
   (Maple), *Gloeosporium apocryptum* E. & E.
   (Oak), *Gnomonia quercina* Kleb.
2. Ash Decline, unknown
3. Brown-Spot Needle Blight, *Scirrhia acicola* (Dearn.) Siggers
4. Chlorosis of Pin Oak and Sweetgum, probably iron/manganese deficiency
5. Chlorotic Dwarf of Eastern White Pine, air pollution
6. Coryneum Twig Blight of Oak, *Coryneum* sp.
7. Dothistroma Needle Blight, *Dothistroma pini* Hulbarry
8. Fireblight, *Erwinia amylovora* (Burr.) Winsl.
9. Frost Injury, weather
10. Gymnosporangium Branch Swelling on Eastern Red Cedar, *Gymnosporangium nidus-avis* Thaxter

11. Phomopsis Blight, *Phomopsis juniperovora* Hahn

12. Rhizosphaera Needlecast, *Rhizosphaera Kalkhoffii* Bub.

13. Sapsucker Injury, yellow-bellied sapsucker (*Sphyrapicus varius*)

Insect and Disease ANNUAL REPORT

Forestry Division

INTRODUCTION

Most of our readers have realized by now that Dr. Patricia E. Gowen-Overton is no longer with the Department of Conservation. Dr. Pat left us on June 1, 1986 to join her husband and assume a teaching position in the Kansas City area. We will miss Pat's expertise and attention to detail and wish her well in her new life.

Although the winter of 1985-1986 was rather mild, various plants suffered from several cold snaps and the lack of snow cover. November of 1985 was very wet with Central Missouri receiving eleven inches.

As Missouri summers go, 1986 was fairly dry in many areas. In October, 1986 we received thirteen inches of rain in the first two weeks causing major flooding in many parts of the state. The weather was not dull, by any means, for 1985-1986.

In spite of the scattered drought conditions in the state our forests are in good condition at this time. There will always be trees dying in the forest from one cause or another.

Tree mortality is especially accentuated in the urban setting where soil compaction, soil removal, root destruction, use of herbicides and girdling of shrubs and trees with mechanized equipment are common.

Department personnel were very busy servicing forest pest inquiries this year. Numerous insect and disease occurrences created problems for owners of forest trees, foresters, Christmas tree producers and anyone else involved with growing trees. Most problems were minor which involved the attention of Forest Pest Specialists and Forest District personnel.

Some trees are still dying from this summer's and earlier droughts, however, with the additional rainfall we should be seeing less tree mortality caused by drought.

Included in this report are pests that have caused damage to forest and urban trees during 1986. Some of the insects and diseases lower the ornamental value of trees, while others cause log and lumber degrade and timber loss.

We serviced a great variety of inquiries involving insect and disease control and identification. Forest Pest Specialists and Forest District Personnel are receiving more inquiries each year because more people are becoming more concerned and aware of pest problems on their trees and are becoming more aware of our Pest Management Program.

As usual, many disease problems developed during the cool, wet periods of spring. During this period as well as early summer, conditions were ideal for the development and spread of fungi which infect leaves, needles and stems. An assortment of tree diseases developed during early and middle summer.

THE PROGRAM

In 1962, a cooperative program, the Forest Pest Control Program, was entered into with the U.S. Forest Service by the Forestry Division, Missouri Department of Conservation. Under the original agreement the effort is designed to detect, evaluate and control forest insects and diseases on state and private land. Department Foresters and other personnel report occurrences of damaging insects and diseases. Forest Pest Management specialists coordinate the program.

Insects, diseases and drought, can cause damage to trees and shrubs which may go unnoticed until mortality occurs. Tree losses occur on an annual basis in the forest from hardwood borers and defoliators; pine cambial feeders; root rot, canker and stem diseases; drought and over maturity.

Trees under stress were vulnerable to attack by insect borers, and a host of canker fungi and root rot fungi. Some factors which stress trees are drought, compacted soil, root disturbance, lightning strike, insufficient soil elements and wet or dry soil conditions to list just a few. Maintaining tree vigor is the most important consideration to insuring a long life.

CONDITIONS IN BRIEF

Rainfall totals were slightly over normal for the year but did not occur during the growing season, a typical scenario for Missouri. Spring arrived about two weeks earlier than normal and April was very dry. Flooding resulted during the first two weeks of October because of above-normal rainfall. Mast production in autumn was good for almost all species of oak.

A late spring frost caused premature dieback of many early sprouting species. Diplodia tip blight was prevalent around the state on Austrian pine. Pine wood nematode was abundant in Scotch pine causing many older trees to die. Oak decline caused by drought and other factors was scattered around the state.

FOREST INSECTS

European Pine Sawfly - occurred in modest numbers on mugo and Scotch pine this spring in scattered locations.

Fall Webworm - occurred in light to moderate numbers on walnut trees and other hardwood species in southwest Missouri in 1986.

Gypsy Moth - during July, August and September of 1986, eight male moths were recovered from traps in Missouri. Of these eight, one moth was trapped in Johnson County near Kansas City and seven were trapped in the St. Louis area. Personnel from U.S.D.A., A.P.H.I.S., PPQ furnished all traps and personnel from the Missouri State Department of Agriculture trapped and coordinated all the trapping in the state.

Insect Galls - various species of hardwood trees were infested by gall insects over the state.

Kermes Scale - was prevalent in 1986 in the St. Louis area.
Redhead Pine Sawfly - began to build in numbers in 1986 in south and east Missouri. They fed primarily of Shortleaf pine, however, several Scotch pine were partially defoliated in Christmas tree plantations.

Spider Mites - infestation and damage occurred statewide on spruce and other species.

FOREST DISEASES

Diplodia Tip Blight - was widespread on older Austrian pines around the state.

Frost Injury - some species affected were yew and sweetgum. Frost injury occurred in various scattered locations across the state.
Oak Mortality - caused by drought and over maturity is still occurring and will as long as Missouri has forests. Oak mortality is part of plant succession.

Pine Wood Nematode - numerous Scotch pines died statewide due to the infestation by the Monochamus beetle and the pine wood nematode.

PROJECTS

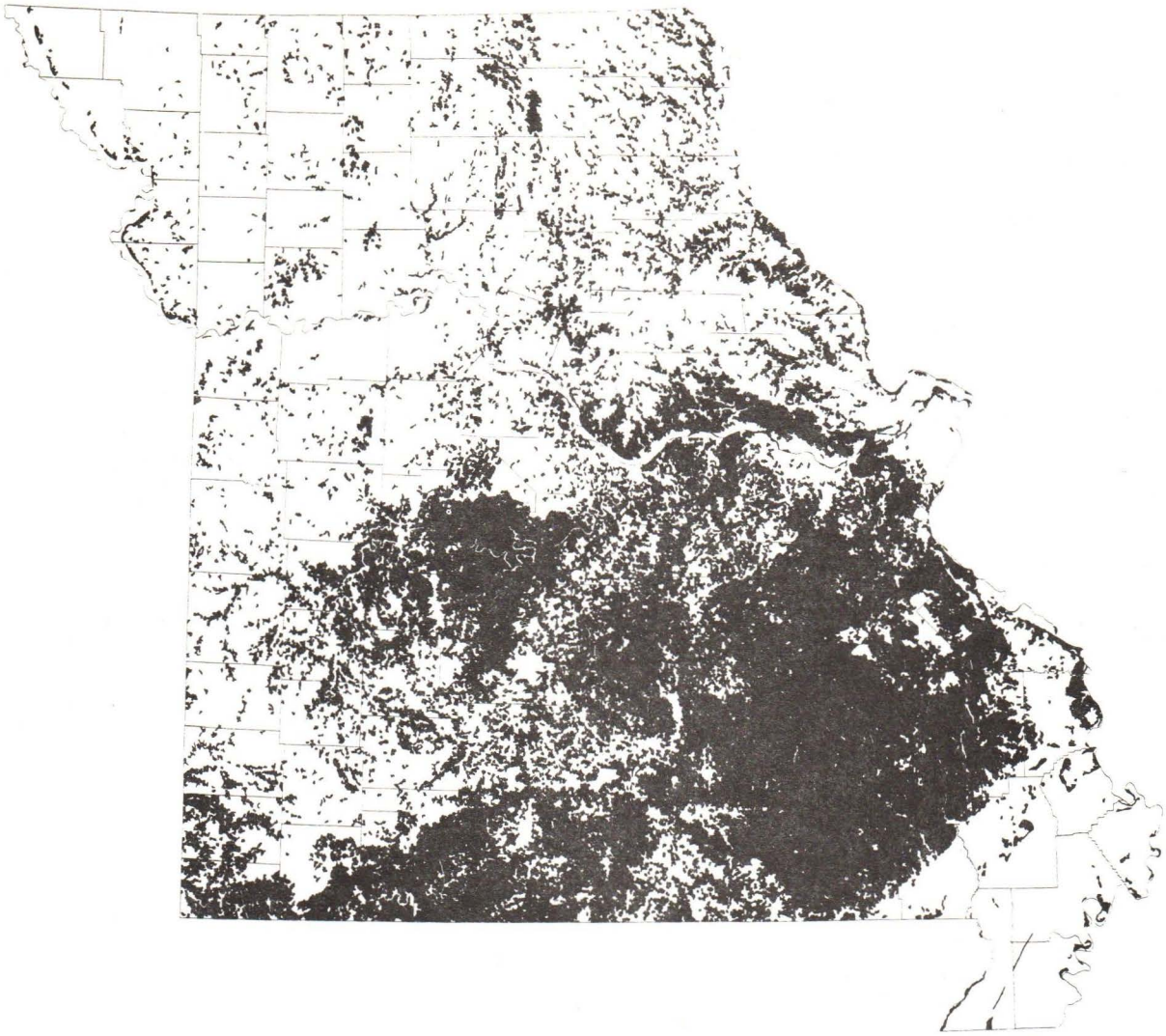
The cooperative team effort of Department Foresters and Forestry Division staff specialists resulted in a well-coordinated, successful Forest Pest Management Program in 1986. Over 3,000 forest and shade tree requests were serviced statewide in 1986. The services of staff specialists were available to foresters and others. In February and March two Pest Management sessions were held in St. Louis and Kansas City for Department Foresters and personnel associated with the green industry. In May another meeting was held in Salem for 25 foresters. These meetings were designed for arborists and urban forest pest management personnel. Over 355 people attended these three meetings. Other meetings were held throughout the state also for special interest groups. Department Foresters and staff specialists serviced over 1,700 pest related telephone calls. Over 1,000 diagnoses of tree problems were made for the state. No serious pest problems were found during visits to the George O. White State Forest Nursery.

Gass and Gowen conducted detection and evaluation surveys on major insect and disease problems in 1986 on 5,000,000 acres. Reports were prepared and submitted to the U.S. Forest Service.

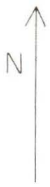
A total of four Forest Insect and Disease Status Reports (May through August) were prepared and sent to all Missouri Christmas Tree Producers, most Department personnel, and other individuals involved in tree care, totaling 1,200 copies per month.

Gass attended the annual State Cooperators Meeting hosted by the U.S. Forest Service in St. Paul, Minnesota in March.

Forest Pest Management Specialists and District Foresters presented technical sessions to arborists and at regional technical seminars and conferences.



FOREST COVER OF MISSOURI



Prepared By
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FEBRUARY, 1986
Data Source: Landsat TM Imagery, 1984

HARDWOOD DEFOLIATORS

Eastern Tent Caterpillar - population low to moderate during the spring of 1986. (spring was dry, April). Heaviest webbing occurred in southeast Missouri.

Trend - populations should be moderate in 1987.

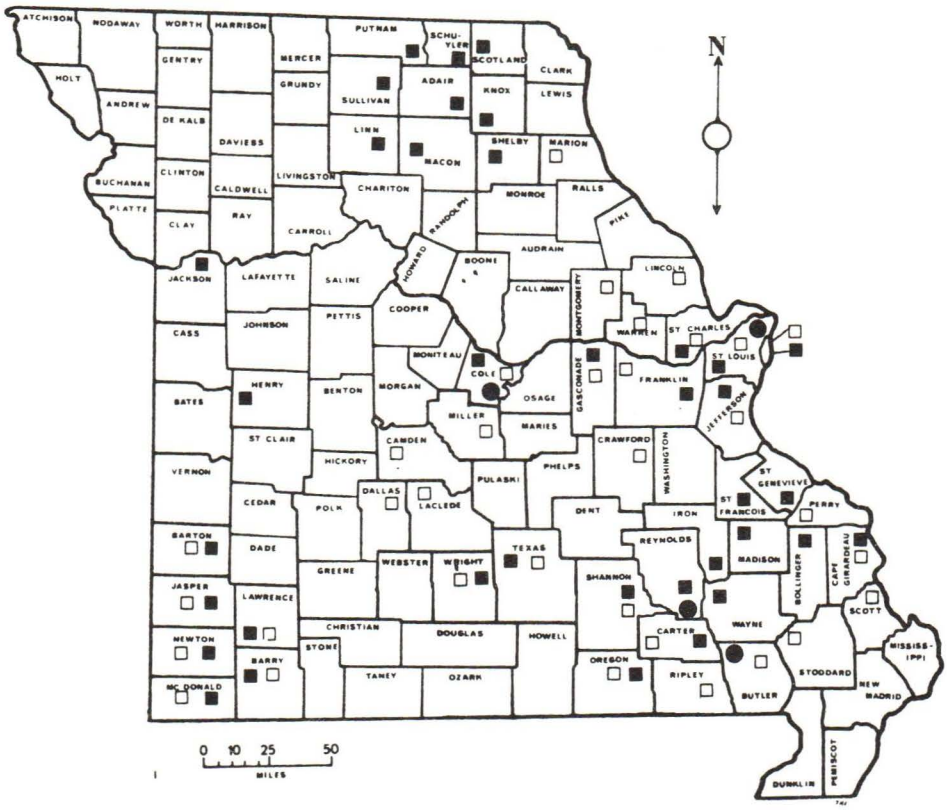
Suppression - No control was necessary.

****

Fall Webworm - populations were moderate to heavy in southwest Missouri in 1986. Infestation of black walnut, pecan, hickory, persimmon and redbud was common. The remainder of the state had low to medium levels of infestation on the same tree species.

Trend - populations should be moderate to heavy in 1987.

Suppression - various walnut and pecan growers sprayed their trees to control this insect.



Gall Insects - numerous reports were received statewide regarding heavy gall infestations in 1986. Gall insects such as flies, wasps, psyllid gall insects and mites are active in spring. These insects lay their eggs in succulent leaf or twig tissue where the swollen parts eventually develop. Galls commonly observed are on hickory, hackberry, and oak leaves. Elm and walnut leaves also have galls in early summer. Woody stem galls are common on oaks.

Trend - insect gall infestation is a part of nature. We will always have insect gall formation with some years heavier than others. Galls will always be difficult to control.

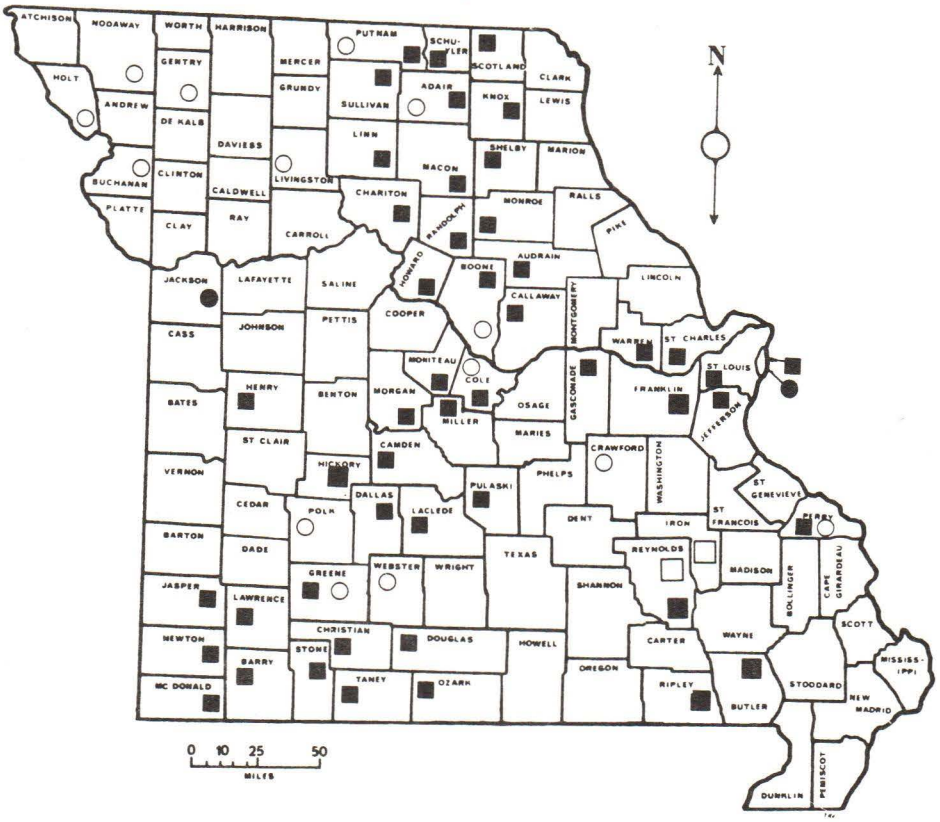
Suppression - no control was conducted for gall insects.

****

True Tree Grasshopper - this tree leaf feeding grasshopper caused light to moderate defoliation this year in Iron and Reynolds Counties. Its preferred hosts are white oak, red oak, hickory and flowering dogwood. Feeding produces a lacy appearance to foliage. It is a forest insect and suppression was not necessary.

****

Kermes Scale - this year was noticeable in the St. Louis area. It causes twig flagging on post oak and white oak. Clusters of two to four scales attach themselves to outer twigs near the beginning of the new years growth. The scales extract sap from beneath the bark of infested twigs.



Trend - populations should be low to moderate in 1987.

Suppression - no suppression was done for Kermes scale.

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Walnut Caterpillar - populations were light to moderate over the state on black walnut, pecan and hickory. Leaf feeding begins in July and ends in September. Other Datana species feed on red oak, post oak, huckleberry and sumac.

Trend - populations in 1987 will be moderate in most areas of the state.

Suppression - a number of nut growers sprayed their trees for this insect with an approved insecticide.

****

Gypsy Moth - during the summer of 1986 the gypsy moth defoliated over 2.4 million acres of forest land in the northeastern United States. Defoliation was the greatest in Pennsylvania with 987,810 acres. Delaware was the lightest with 3,118 acres. Spot infestations still remain in several states while the infested range continues to grow in central Michigan. Personnel of the Missouri State Department of Agriculture trapped 7 male moths in the St. Louis area, one near Holden in Johnson County. To date, no spot infestations have been discovered in Missouri. In 1986, 7,320 gypsy moth traps provided by U.S.D.A., A.P.H.I.S; P.P.Q., were located and monitored by personnel of the Missouri State Department of Agriculture, Plant Industry Division and in cooperation with the U.S.D.A., Animal Plant Health Inspection Service. Other cooperating agencies were the Department of Natural Resources, State Parks and Historic Preservation, National Campers and Hikers Association, Corps of Engineers, and John Grinstead at Fort Leonard Wood.

The gypsy moth is not native to the United States, however, its life cycle does parallel that of a number of other native insects. In spring and early summer, larvae feed on a great variety of hardwood foliage. With three repeated defoliations of hardwood, tree mortality can occur. One defoliation can kill evergreen trees such as cedar or pine.

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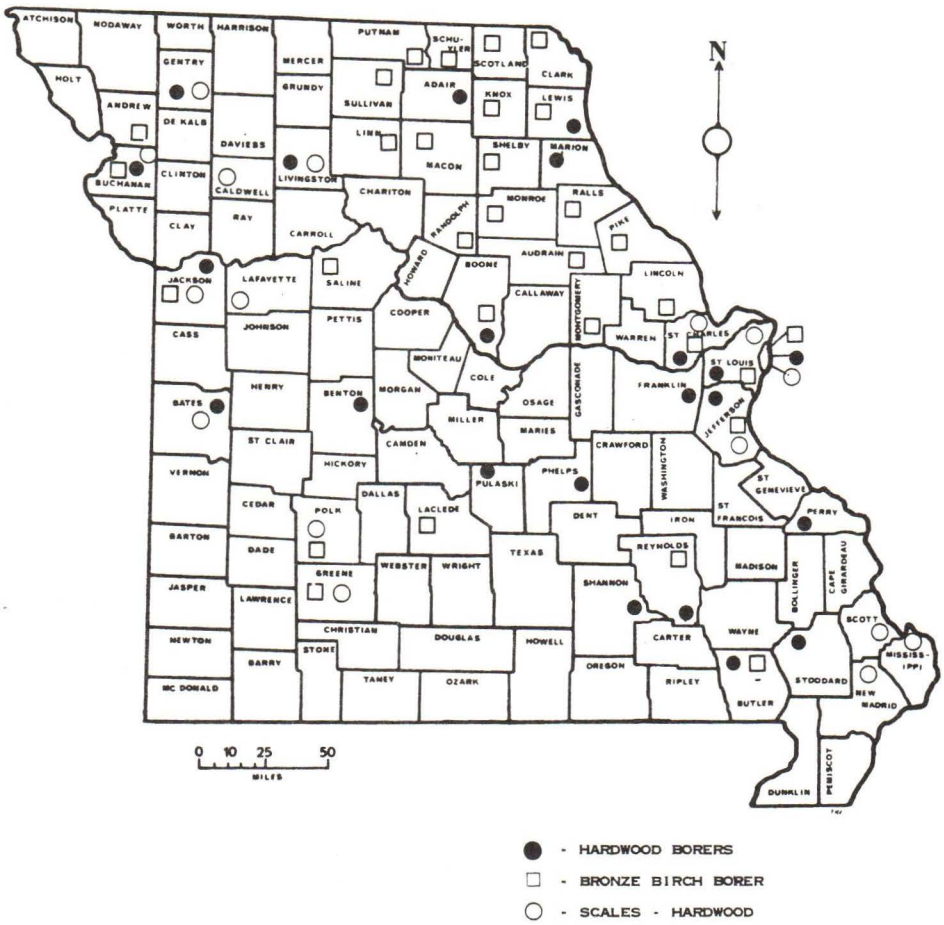
Looper Complex - although defoliation was low to moderate this group of insects was represented in about forty counties in eastern Missouri. (see distribution map) The term looper complex is used to describe five different insects which emerge and feed on a variety of hardwood foliage at the same time of the year. Common loopers are the Linden Looper, elm spanworm, spring cankerworm, leaf roller and leaf tier. It may take four or five

years for looper complex populations to build to a high level. Predators and parasites usually are responsible for the collapse of large populations of the looper complex.

Trend - populations likely will be light to moderate in 1987.

Suppression - no suppression work was done in 1986.



HARDWOOD BORERS

The Cottonwood Twig Borer, Cottonwood Borer, Cottonwood Leaf Beetle and Poplar Tent Maker - continue to infest cottonwood where it grows. Borer damage is greater in trees growing on poor sites. Defoliation by the Poplar Tent Maker occurs almost everywhere cottonwood grows.

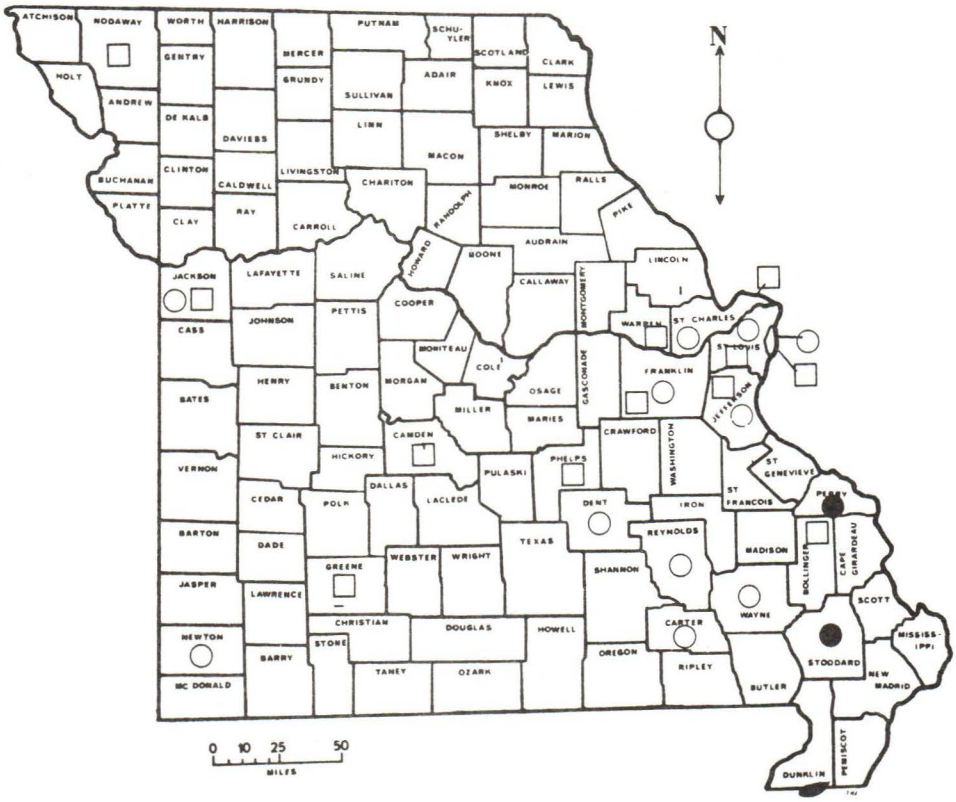
Trend - No increase in infestation is expected in 1987.

Suppression - no spray work was conducted in 1986.

Two-lined Chestnut Borer - the two-lined chestnut borer is not a primary attacker of live healthy trees. It is a secondary attacker of stressed black and scarlet oak as well as shingle oak. It plays a role along with various root rots and Hypoxylon canker in finally killing stressed oak trees. Beginning in 1978, and through 1980, moisture was a limiting factor for tree growth, triggering attacks by the two-lined chestnut borer and root rots. In 1983 and 1984, drought conditions prevailed from late June through September over most of the state. As a result of the effects of drought, many more oak trees were lost. Other tree stressing factors are late frosts, poor sites and spring defoliating insects.

Trend - the summer of 1986 was rather dry in central Missouri and several other areas. The majority of trees stressed in 1980 have died. Other trees dying in the forest are part of the natural succession of a maturing forest. Drought will always play a role in tree mortality. With adequate rainfall during the growing season of 1987 trees should fare well. Without adequate moisture, trees will be stressed.

Suppression - Drought hazard sites must be recognized and managed in such a manner as to pay attention to species composition. Alternatives to even-aged management and conversion to shortleaf pine where hardwood basal is too low should be considered. On marginal hardwood sites the entomological and pathological rotation should be used rather than a fixed rotation age.



The Carpenterworm and Red Oak Borer - and other living hardwood tree borers as part of our endemic, indigenous borer populations continue to infest hardwood trees in forested areas of the state. Hardwood borers are a major problem on many hardwood trees in urban areas.

Trend - Borer infestation will continue in hardwood trees occupying poorer sites. Estimated dollar loss to the hardwood borer complex amounts to $2,250,000 annually through lumber degrade and ornamental tree loss.

Suppression - selective tree harvest, sanitation harvest and stand conversion, from hardwood to pine were conducted in forested areas over the state. Some shade tree owners controlled borer infestations on high value trees.

PINE AND CEDAR TRUNK BORERS, TWIG BORERS AND DEFOLIATORS

Black Turpentine Beetle - light infestations were reported from Perry and Stoddard Counties in 1986. The black turpentine beetle infests weakened shortleaf pine trees - those damaged in a timber sale, damaged during building construction, windthrown or those struck by lightning. Once the infestation has proceeded and is successful, the Ips beetle can also develop, completing the process of killing the tree.

Trend - beetle populations will develop where shortleaf pine trees are disturbed either naturally or artificially.

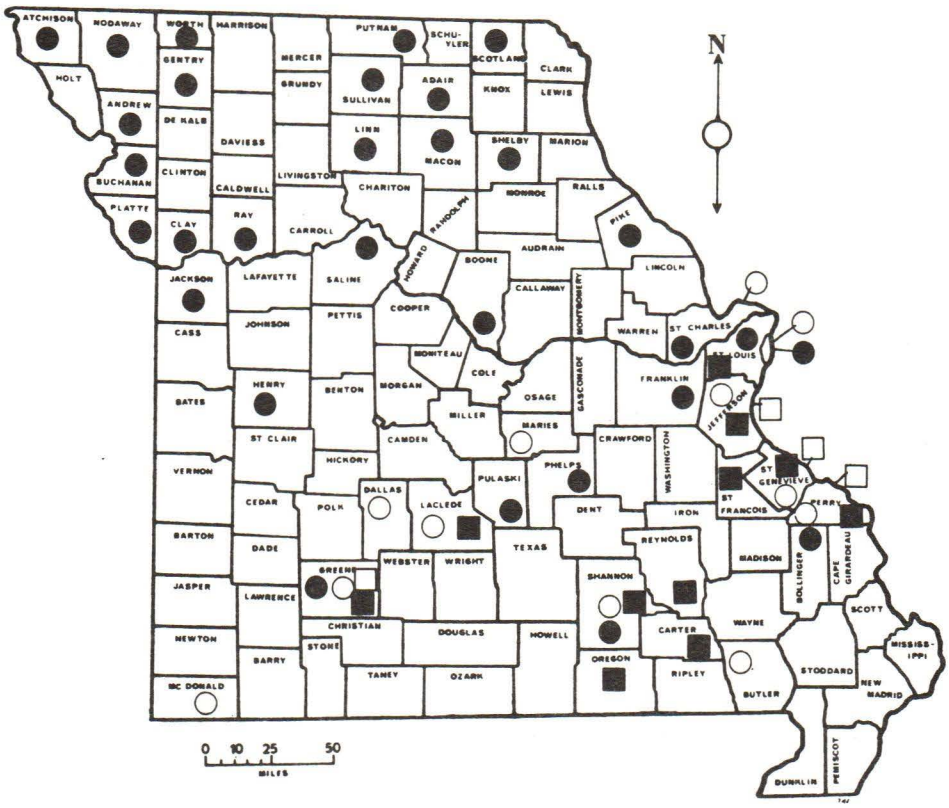
Suppression - where feasible, attacked trees are removed as timber cutting progresses in timber sale areas.

****

European Pine Sawfly - populations were large in 1986 with defoliation being moderate to heavy on Scotch and mugo pines in 33 counties in the state. Affected trees were grown for ornamental or Christmas Tree purposes. This insect is traditionally a spring and early summer feeder.

Trend - population levels will be moderate to heavy again in 1987.

Suppression - a number of Christmas Tree producers and homeowners sprayed their trees and shrubs for the European pine sawfly.



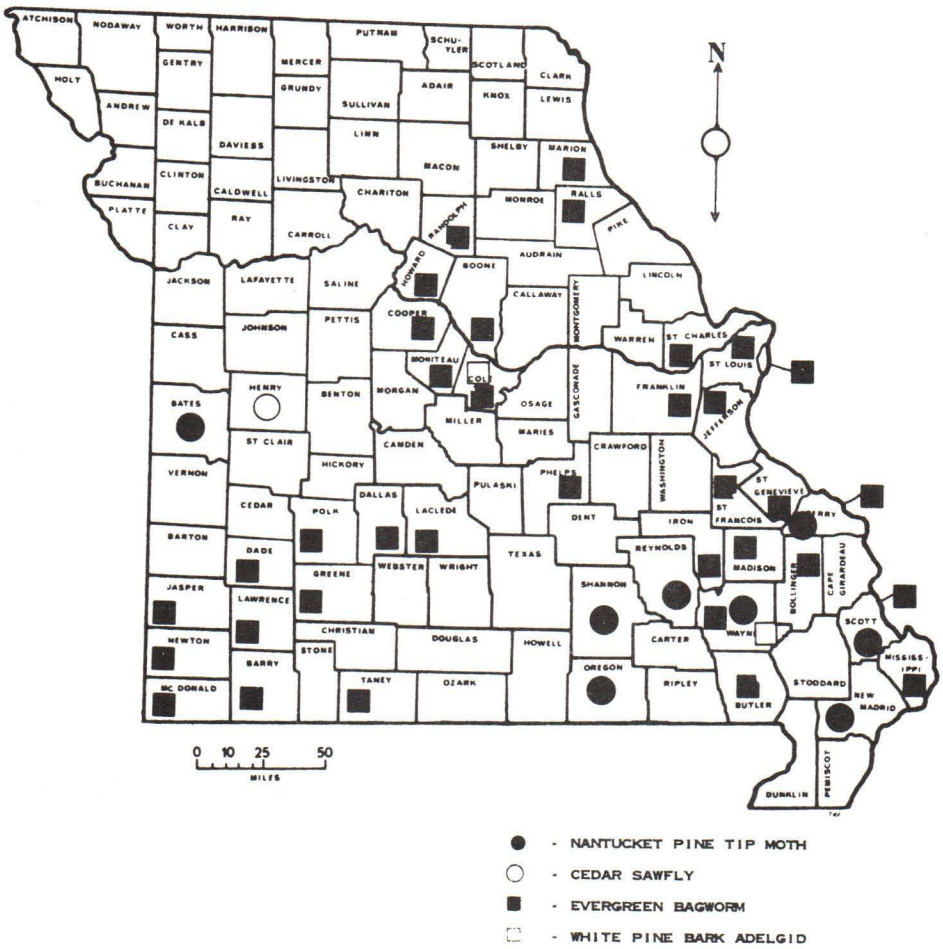
Evergreen Bagworm - infestations of bagworms were light to heavy on Eastern redcedar and upright pfitzer junipers over the state. Often, heavy areas of defoliation on a juniper can cause its death over a two or three year period.

Trend - Bagworms will continue to threaten unsprayed ornamental evergreens. Populations are expected to be light to heavy statewide in 1987.

Suppression - some owners of evergreens had their shrubs sprayed by tree service companies.

****

Ips Beetle - is a weak attacker of live, healthy shortleaf pine trees. It is most usually detected on very stressed pines and pines that have infestations of black turpentine beetles. If new pine slash is created, Ips often infests this slash and will later infest live healthy neighboring pine trees. Ips was reported from five counties in 1986. Ips has also been attacking white pine and Scotch pine in metropolitan areas.



Trend - Ips will continue in stressed or weakened pine.

Suppression - sanitation harvest was conducted where pine trees were infested.

****

Loblolly Pine Sawfly - populations were light to moderate in 1986. This is an early summer defoliator of shortleaf and Scotch pines. In 1986 we observed larva feeding only on planted trees.

Trend - populations will be light to moderate in 1987.

Suppression - no suppression was accomplished during 1986. Our standard control recommendation is to spray stumps produced during the previous Christmas with Thiodan and diesel fuel in March of the following year. Unless growers already have the problem they usually don't take control measures to prevent possible weevil build-ups for the following year.

****

Pale Weevil - populations were very low in 1985. Infestations were reported for three counties where feeding and flagging occurred in Christmas tree plantations.

Trend - populations should be light in 1986.

Suppression - no suppression was required this year. Our standard control recommendation is to spray stumps produced during the previous Christmas with Thiodan and diesel fuel in March of the following year. Unless growers already have the problem they usually don't take control measures to prevent possible weevil buildups for the following year.

****

Pine Needle Scale - populations increased on Scotch and mugo pine needles in eleven counties in 1986. Scales build up on needles in such large numbers that the plant appears to be whitewashed. Present infestations are at the level where only small groups of trees or shrubs are infested, however, there is the potential for greater spread of the scale to other plants.

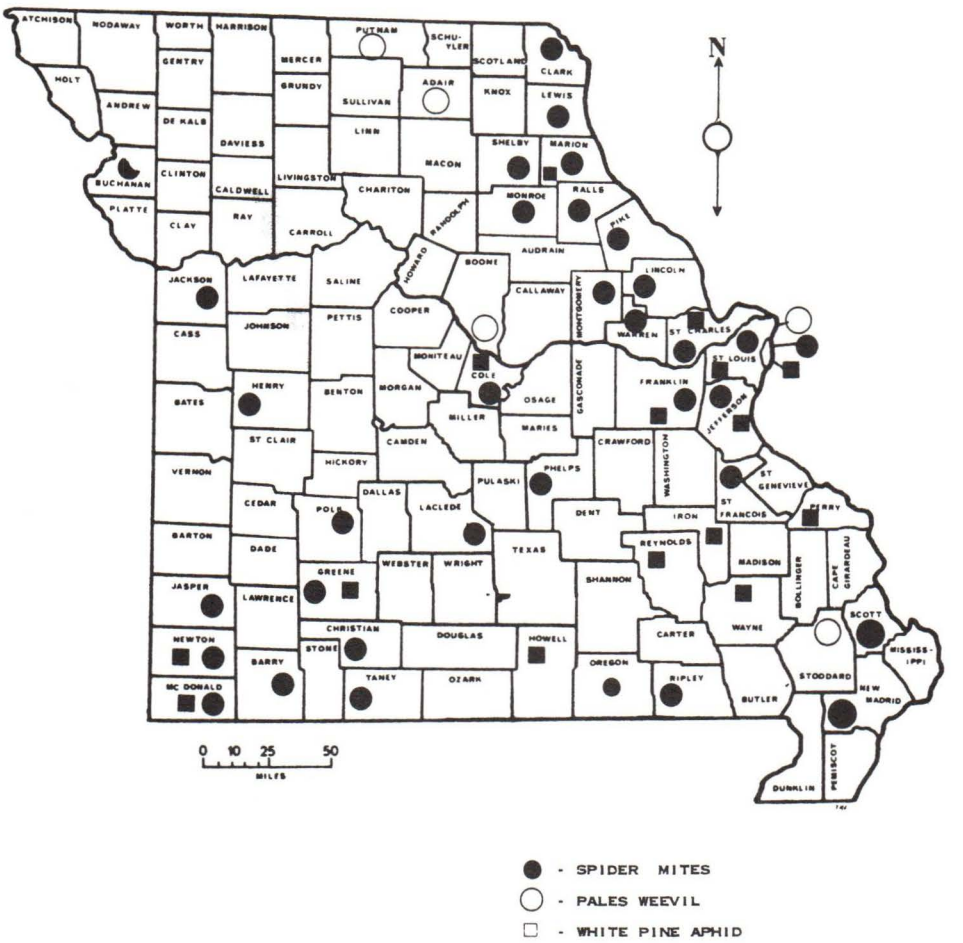
Trend - populations are growing and unless a natural; factor occurs to reduce the present populations, we will see additional activity in 1987.

Suppression - Several growers sprayed individual and selected trees and shrubs for control of the pine needle scale.

Redheaded Pine Sawfly - populations were light to moderate in 1986, being reported from eleven counties in south Missouri. Defoliations were light to heavy in scattered plantations.

Trend - It is apparent that populations are building and that defoliation will increase in 1987.

Suppression - individual infested shortleaf and Scotch pines were sprayed with an approved stomach poison.



Spider Mites - were damaging to a variety of conifers around the state in 1986. They were especially damaging to Scotch pine, baldcypress, Norway spruce, white pine, Colorado and white spruce. Reports of occurrence were received from thirty-four counties. Our traditional hot and dry summers make ideal feeding conditions for most species of spider mites on needles of coniferous trees. Feeding by spider mites produces a light-green color to the needles. Upon closer examination, egg cases, mites and webbing can be observed on infested plant material.

Trend - spider mite damage will be heavy again in 1987. Although feeding seldom directly kills trees, it does stress them and damages the aesthetic value of Christmas trees or ornamental plants.

Suppression - arborists use Kelthane as a standard miticide to control the various species of spider mites. Christmas tree producers spray their Scotch pine trees for spider mites as the problem occurs.

****

Pine Tortise Scale - infested a number of trees in several Christmas tree plantings around the state. This insect does not normally become epidemic in a planting because of natural predation by lady beetles and predaceous bugs. Only larger trees are usually affected in random plantations.

The affected trees were heavily infested with scale on the small twigs. The infestation was detected by the presence of large concentrations of honeydew which had molded, imparting a black cast to the entire tree.

Trend - populations will build only slightly in 1987.

Suppression - Christmas tree producer was advised to spray a dormant oil on only those trees infested prior to winter. If required, growers will spray their infested trees in late May of

1987 with Sevin or Dursban to control in the crawler stage of the scale.

****

White Pine Aphid - populations were large on scattered white pine trees over the state. This aphid sucks the sap from small twigs and needles. The honey dew which the aphid produces eventually turns a gray-black. The aphid was reported from fifteen counties in 1986.

Trend - populations should be low to moderate on white pine in 1987.

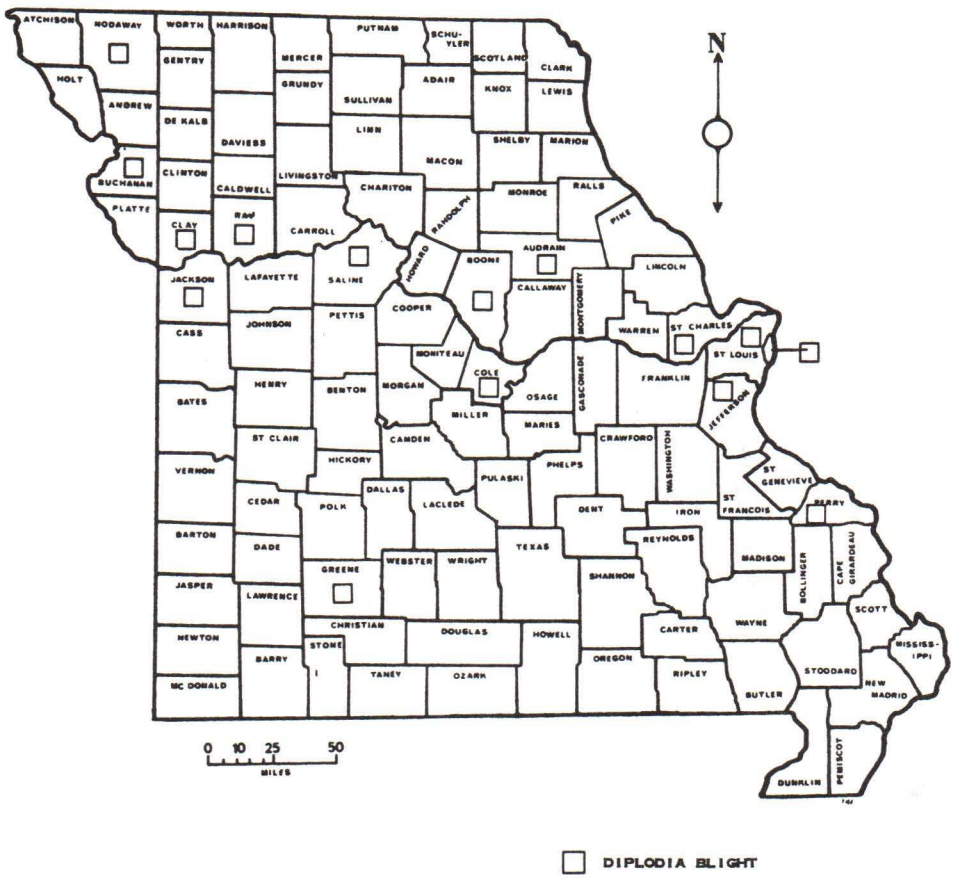
Suppression - some owners had their white pine trees sprayed with Kelthane to control the aphid.

FOREST AND ORNAMENTAL TREE DISEASES

Diplodia Blight - was a major cause of shoot and branch dieback of mature Austrian pines (25 years old and older). Some mature Scotch pines also exhibited shoot dieback. The disease was widespread, occurring in fifteen different counties over the state.

Trend - Diplodia blight is endemic in Missouri. Numerous mature Austrian pines can be expected to be infected in the future.

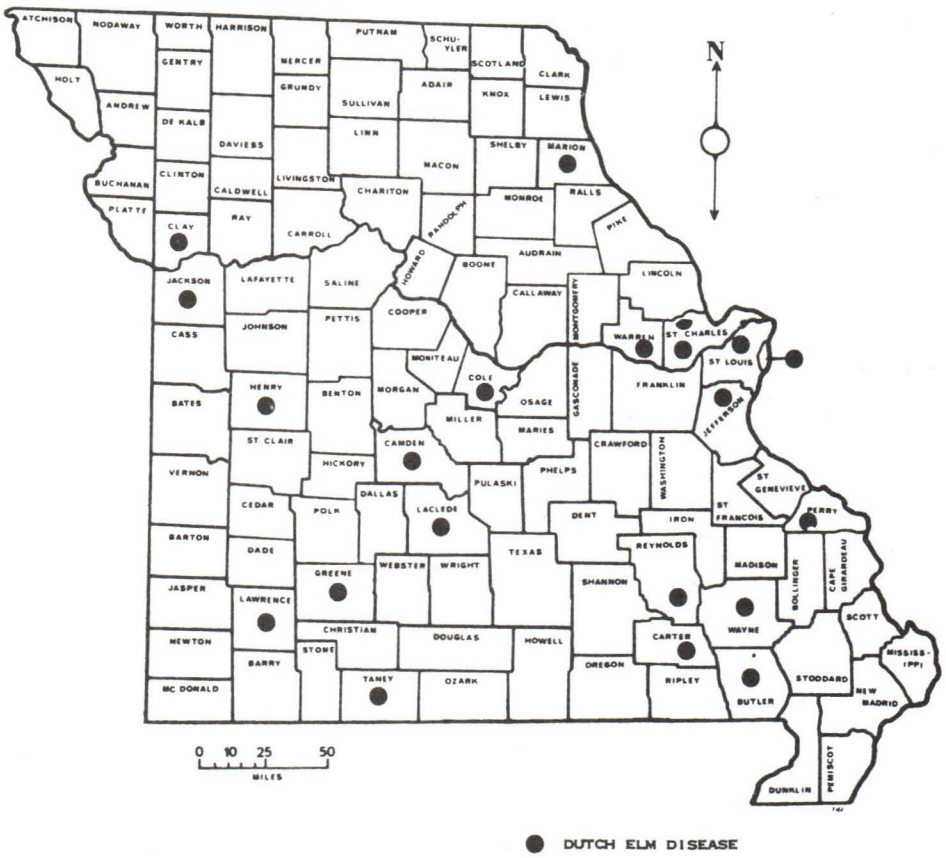
Suppression - dead and dying pines are removed on an individual basis. Benomyl and Bordeaux mixture are fungicides used in large urban areas for control.



Dutch Elm Disease - was widespread but not as prevalent in 1986 as in 1985. Both forest and ornamental American elms were affected in twenty counties in Missouri in 1986.

Trend - although Dutch elm disease is an imported disease, it is presently endemic in Missouri. Continued losses of American elms can be expected to occur in the future.

Suppression - Dead and dying elms are removed on an individual basis. Chemical injections are used to treat individual high-value elms, but are not a common treatment.



Oak Decline - of white, Northern red, black, scarlet, pin and shingle oaks were common in 1986. Although not nearly as numerous as in the early 1980's decline was noticeable in scattered locations in Missouri's forests. Fewer trees were affected in 1986 than in 1985. Decline is a function of drought as a predisposing factor leading to the attack by secondary insects and diseases.

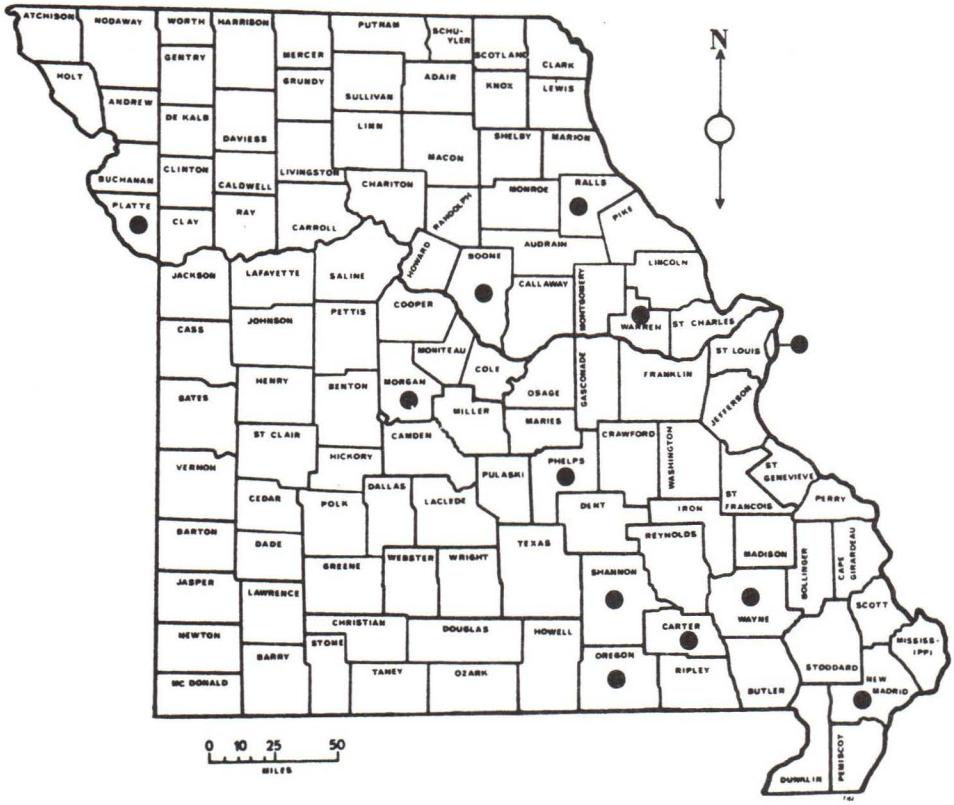
Trend - the droughts of 1980, 1983, 1984, and 1986 stressed many oaks and made them susceptible to a complex of secondary agents. Oak decline will decrease when we receive adequate rainfall in the future.

Suppression - dead and dying oaks were removed in dead oak harvests in the forests and on an individual basis in the urban setting.

Oak Wilt - on variety oak species were reported from twelve counties in Missouri during 1986. None of these observations were positively identified by culturing for oak wilt. Oak wilt was not a serious problem this year.

Trend - Oak wilt is endemic in Missouri. Scattered forest and ornamental trees can be expected to become infected in the future. No infection centers or large scale mortality of oaks is expected to result from oak wilt.

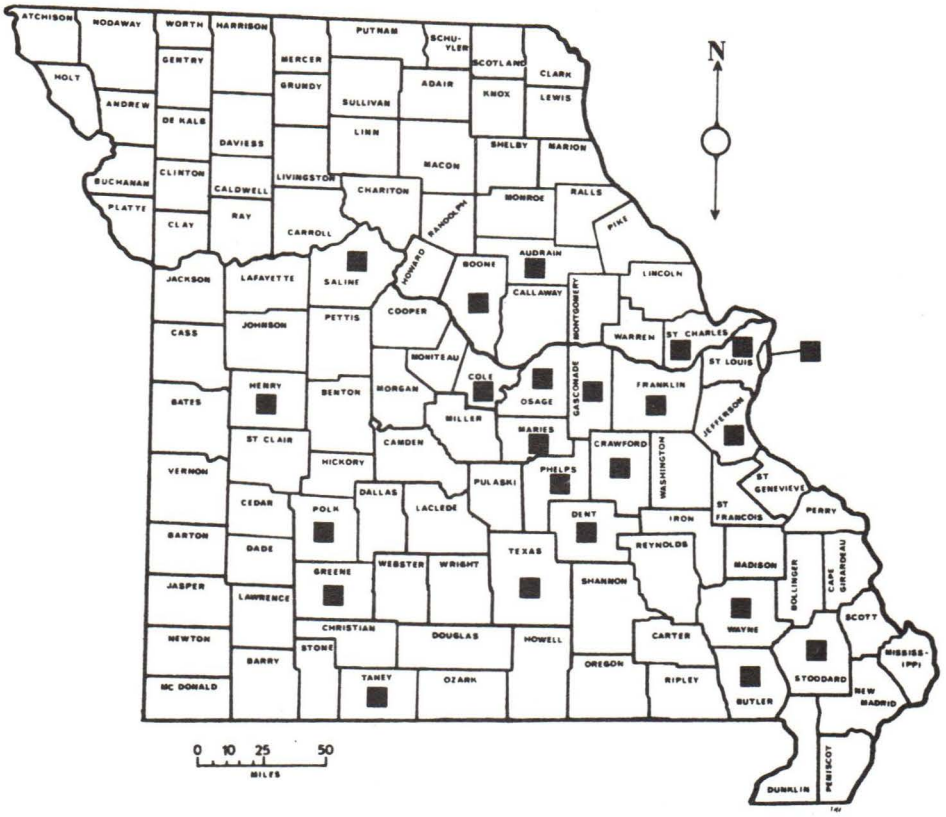
Suppression - it is recommended that pruning of oaks be performed either in winter (while trees are dormant) or late summer, to help avoid attracting insects which could carry spores of the oak wilt fungus. Dead and dying oaks are removed on an individual basis.



Pine Wilt Disease - caused mortality of numerous Scotch pines throughout the state in 1986. The condition, caused by stress to the tree and feeding by a long-horned beetle, Monochamus, introduces large numbers of nematodes into the tree. The nematodes reproduce rapidly in the tree which plug the resin canals in the tree causing it to die. Pine wilt disease is at an epidemic stage in Missouri presently.

Trend - Pine wilt disease is endemic in the state. High losses of ornamental Scotch pine can be expected in the future. Scotch pines seldom live longer than 25 years in Missouri due to pine wilt disease which is predisposed by dry summers. We are recommending to future homeowners not to plant Scotch pine as an ornamental tree because of its short life.

Suppression - there is no control for pine wilt disease. Dead and dying trees are removed annually on an individual basis.



CONCLUSION

Rainfall amounts were rather spotty during the growing season of 1986. Central Missouri was very dry for June, July, August and September while other areas fared better. Trees growing in these dry areas were stressed. Again, conditions were favorable in spring, for the build up of leaf and needle diseases during middle and late summer. Because of the localized drought conditions, leaf scorch was a problem.

We completed our fifth season with the Integrated pest Management Program (IPM) with the University of Missouri-Columbia. This multi-state reporting program has been developed to collect and computerize pest occurrence data for most economic plant pests in the state. Forestry Division is reporting results to the IPM program for incidence of diseases and insects on forest and ornamental trees.

Because of our field forester's reports we have been able to collect and assemble this statewide pest incidence information.

Cooperation and team effort has always been our key to a successful Forest Pest Management Program.

INSECT-HOST	COUNTY
Bagworms (on evergreens)	Statewide
Black Turpentine Beetle (shortleaf pine)	Perry, Stoddard
Borers (hardwood trees)	Andrew, Bates, Benton, Boone, Buchanan, Butler, Franklin, Gentry, Jackson, Jefferson, Johnson, Lewis, Livingston, Marion, Perry, Phelps, Pulaski, Reynolds, Shannon, St. Charles, St. Louis, St. Louis City
Bronze Birch Borer (white birch)	Statewide
Cedar Sawfly (eastern redcedar)	Henry
Eastern Tent Caterpillar (*Prunus* sp.)	Statewide
European Pine Sawfly (Scotch and mugo pines)	Adair, Andrew, Atchison, Bollinger, Boone, Buchanan, Clay, Franklin, Gentry, Greene, Henry, Jackson, Jefferson, Knox, Lafayette, Linn Moniteau, Nodaway, Phelps, Pike, Platte, Pulaski, Putnam, Ray, Saline, Scotland, Shannon, Shelby, Sullivan, St. Charles, St. Louis City, St. Louis, Worth
Fall Webworm (on black walnut other hardwood species)	Statewide, where host species occur
Gall Insect (assorted hardwoods)	Statewide
Gypsy Moth (in traps)	St. Louis and Johnson
Ips (shortleaf and white pine)	Carter, Dent, Franklin, Jackson, Jefferson, Newton, Reynolds, St. Charles, St. Louis City, St. Louis County, Wayne
Kermes scale (post oak)	St. Louis County, St. Louis City
Looper Complex (on assorted hardwoods)	Statewide
Loblolly Pine Sawfly (shortleaf pine)	Butler, Dallas, Greene, Jefferson, Laclede, Maries, McDonald, Perry, St. Charles, Ste. Genevieve, St. Louis County, St. Louis City

Nantucket Pine Tip Moth (Shortleaf and Scotch pines)	Bates, New Madrid, Oregon,Perry, Reynolds, Scott, Shannon, Wayne
Pales Weevil (Scotch pine)	Adair, Boone, Putnam, St. Louis, Stoddard
Redheaded Pine Sawfly (shortleaf and Scotch pines)	Carter, Greene, Jefferson, Laclede, Oregon, Perry, Reynolds, Shannon, St. Francois, Ste. Genevieve, St. Louis
Scale (hardwoods)	Bates, Buchanan, Caldwell, Greene, Jackson, Jefferson, Lafayette, Mississippi, New Madrid, Polk, Scott, St. Charles, St. Louis City, St. Louis County
Scale (pine)	Bollinger, Camden, Franklin, Greene, Jackson, Jefferson, Nodaway, Phelps, St. Charles, St. Louis, St. Louis City
Spider Mites (assorted conifers)	Barry, Buchanan, Christian, Clark, Cole, Dallas, Franklin, Greene, Henry, Jackson, Jasper, Jefferson, Laclede, Lewis, Lincoln, Marion, McDonald, Montgomery, Monroe, New Madrid, Phelps, Pike, Polk, Ralls, Ripley, Scott, Shelby, St. Charles, St. Louis, St. Louis City, St. Francois, Taney, Warren
True Tree Grasshoppers(hardwoods)	Iron, Reynolds
Two-lined Chestnut Borer(oaks)	In counties with stressed oak trees - Statewide
Walnut Caterpillar (walnut, pecan, hickory)	Adair, Boone, Buchanan, Cole, Crawford, Greene, Holt, Nodaway, Perry, Polk, Putnam, Webster
White Pine Aphid (white pine)	Cole, Franklin, Greene, Howell, Iron, Jefferson, Marion, McDonald, Newton, Perry, Reynolds, St. Charles, St. Louis, St. Louis City, Wayne
White Pine Bark Adelgid (white pine)	Cole, Wayne

PEST AND HOST	COUNTY
Actinopelte Leaf Spot (assorted oaks)	Buchanan, Franklin, Grundy, Jackson, Jefferson, St. Charles, St. Louis, St. Louis City
Anthracnose(sycamore, oak, and ash)	Adair, Barry, Barton, Benton, Boone, Butler, Caldwell, Cape Girardeau, Carter, Cass, Cedar, Clay, Cole, Cooper, Dade, Franklin, Greene, Henry, Iron, Jackson, Jasper, Jefferson, Johnson, Knox, Lafayette, Lawrence, Linn, Macon, Marion, McDonald, Newton, Nodaway, Phelps, Platte, Polk, Putnam, Ray, Reynolds, Schuyler, Scotland, Stone, Sullivan, Taney, St. Charles, St. Louis, St. Louis City
Apple Scab (flowering crab species)	Jackson
Armellaria Root Rot (hardwoods)	Boone, Mississippi, Perry, Stoddard, Stone, St. Louis, Taney
Brown-Spot Needle Blight (Scotch pine)	Clay, Clinton, Franklin, Jefferson, Laclede, Lafayette, St. Charles, St. Louis, St. Louis City, Warren, Worth
Cedar Apple Rust (Eastern red cedar)	Atchison, Boone, Camden, Christian, Clay, Cole, Douglas, Greene, Henry, Jackson, Jefferson, Laclede, Nodaway, Phelps, Polk, Reynolds, Shannon, St. Charles, St. Francois, St. Louis, St. Louis City, Taney
Cytospora Canker (spruce)	Douglas, Greene, Jasper, Newton, Perry
Diplodia Blight (Austrian pine)	Audrain, Boone, Buchanan, Clay, Clinton, Cole, Greene, Jefferson, Nodaway, Perry, Ray, St. Charles, St. Louis, St. Louis City, Saline

Dothistroma Needle Blight (Austrian Pine)	Audrain, Boone, Buchanan, Clay, Clinton, Cole, Greene, Jefferson, Nodaway, Perry, Ray, St. Charles, St. Louis, St. Louis City, Saline
Dothistroma Needle Blight (Austrian Pine)	Adair, Greene, Jackson, Marion, Phelps, Ray, Reynolds, St. Louis
Dutch Elm Disease(american elm)	Butler, Clay, Camden, Carter, Cole, Henry, Jackson, Jefferson, Laclede, Lawrence, Marion, Perry, Reynolds, St. Charles, St. Louis, St. Louis City
Fireblight (Bradford pear, cotoneaster, pyracanthia)	Barry, Barton, Butler, Camden, Carter, Cole, Iron, Jasper, Jefferson, Laclede, Osage, Perry, Phelps, Reynolds, St. Charles, St. Francois, St. Louis, St. Louis City, Taney, Wayne
Fomes annosus (shortleaf pine)	Carter, Wayne
Oak Decline (assorted oaks)	Boone, Butler, Carter, Cole, Iron, Johnson, Laclede, Madison, New Madrid, Phelps, Reynolds, Scott, Shannon
Oak Wilt (black and red oaks)	Boone, Carter, Morgan, New Madrid, Phelps, Platte, Ralls, Shannon, St. Louis, St. Louis City, Warren, Wayne
Pine Wilt Disease (Scotch pine)	Audrain, Boone, Butler, Cole, Crawford, Dent, Franklin, Gasconade, Greene, Henry, Jefferson, Maries, Osage, Polk, Saline, Stoddard, St. Charles, St. Louis, St. Louis City, Taney, Wayne
Phomopsis Blight (juniper sp.)	Carter, Christian, Clay, Cole, Greene, Jackson, Reynolds, Wayne
Rhizosphaera Needlecast (white and blue spruce)	Barry, Boone, Christian, Cole, Franklin, Greene, Jefferson, McDonald, Newton, Polk, Taney
Verticillium Wilt (assorted	Boone, Cole, Jackson, Jefferson, Platte, St. Charles, St. Louis, St. Louis City, Warren, Wayne
White Pine Root Decline (white pine)	Cole, Jackson, Ripley, St. Louis, St. Louis City